

BREEDING, FORAGING, AND VOCAL BEHAVIOR OF THE WHITE-THROATED JACAMAR (*BRACHYGALBA ALBOGULARIS*)

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ABSTRACT.—We studied White-throated Jacamars (*Brachygalba albogularis*) at Manu National Park, Peru, finding a mean population density of 0.8 groups per km of suitable streamside habitat, and taking the first recordings of its song. Observations at nests provided the first evidence of cooperative breeding in the genus *Brachygalba*, as well as information on foraging tactics, prey selection, and provisioning behavior. Received 27 June 2002, accepted 18 December 2002.

The Jacamar family (Galbulidae) includes 18 species, all of which are cavity-nesting aerial insectivores confined to the Neotropics (Tobias 2002). Within this family, the genus *Brachygalba* contains four closely related allopatric species, which together form a super-species (Haffer 1974): the Dusky-backed Jacamar (*Brachygalba salmoni*), Pale-headed Jacamar (*B. goeringi*), Brown Jacamar (*B. lugubris*), and White-throated Jacamar (*B. albogularis*; Fig. 1). A description of breeding behavior has been published for the Pale-headed Jacamar in Venezuela (Skutch 1968), but no such information is available for its congeners, and very little is known about their diet, foraging behavior, and vocalizations (Tobias 2002). To help fill these gaps in knowledge we studied one of the most poorly known members of the family, the White-throated Jacamar, a species restricted to the forests of southeastern Peru, northeastern Bolivia, and western Brazil.

We gathered data over two months (August–September 2001) at Cocha Cashu Biological Station (71° 19' W, 11° 51' S), Manu National Park, Peru, a site within pristine lowland, tropical moist forest (see Terborgh 1983 for habitat description). White-throated Jacamars were associated with successional habitat (*Gynerium* cane and bamboo with an open canopy of *Cecropia* trees) in the immediate vicinity of shallow whitewater streams about 5 m wide; indeed, the species has never been observed away from whitewater streams dur-

ing the many years of fieldwork at the site (J. W. Terborgh pers. comm.). It also seems to be restricted to similar secondary growth at the edge of *várzea* forest and along whitewater streams or broader whitewater rivers in northern Bolivia (Parker and Remsen 1987), and western Brazil (Whittaker and Oren 1999). Its habitat requirements apparently are rather specialized.

We recorded two types of vocalizations during our field work, both of which, being distinctive, constituted the best means of locating the species. The call was a single (though disyllabic) upwardly inflected note (Fig. 2a), corresponding to the “plaintive, upslurred ‘psueet’” mentioned by Parker and Remsen (1987:98) and presented by Schulenberg et al. (2000). It was quite similar to, but slightly huskier and more disyllabic than, the call of the Swallow Tanager *Tersina viridis*, a species that was nesting alongside the jacamars in earthen banks along the creeks. Individual jacamars gave this call fairly frequently throughout the day (generally 1–2 times every few min), but the rate of calling increased markedly when they perched outside nest holes (mean = 10 calls/min \pm 12.8 SD, range = 0.7–55.0; data from a 6.5-h observation period on 27 August). Even when several adults sat together on the same perch near the entrance to their nest, calling simultaneously, they were relatively subdued and undemonstrative. They never bobbed the head or raised the crown feathers in the manner of *Galbalcyrhynchus* jacamars, but sometimes flicked the tail and rotated the body from side to side when excited.

On about five separate occasions, while perched high above the ground, at least one of the jacamars gave a more complex (and

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FIG. 1. Three adult White-throated Jacamars waiting to deliver food items to nestlings at Cocha Cashu, Manu National Park, Peru, 27 August 2001. Photograph by Joseph A. Tobias.

previously undescribed) song. This was quite low in volume and weak in tone, beginning with a brief rising twitter, which abruptly decelerated and developed into a descending series of more evenly pitched, emphatic, plaintive notes (Fig. 2b). This general format is similar to the songs, or parts of songs, of other jacamar species in the genera *Brachygalba* and *Galbula* (although members of the latter genus are larger with stronger and richer voices). All White-throated Jacamars seemed rather unresponsive to tape playback, sometimes answering calls or songs but rarely, if ever, approaching.

By repeatedly walking along one white-water stream listening for vocalizations and scanning high *Cecropia* branches, we found that eight groups (mean size = 4.6 individuals, range = 3–6) occupied stable territories along a 6.5-km stretch of suitable habitat (measured along the stream itself). While this roughly equates to one breeding group per 0.8 km, the pronounced meander of streams

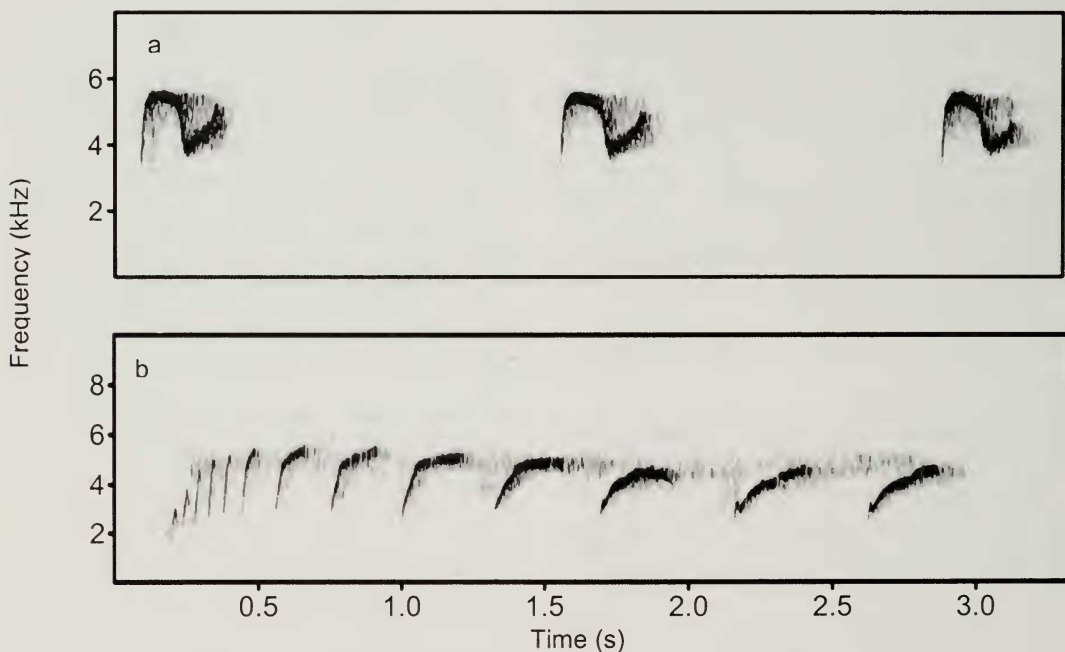


FIG. 2. Spectrograms of (a) the call and (b) song of the White-throated Jacamar, recorded by Joseph A. Tobias at Cocha Cashu, Manu National Park, Peru in August 2001. Using the PC sound analysis software Avisoft SASLabPro, taped recordings were digitized with a 16-bit acquisition card at sampling rates of 16,000 Hz and 22,050 Hz respectively. Calls were filtered to prevent aliasing (low-pass filter, $f_c = 6,000$ Hz) and to remove background noise (high-pass filter, $f_l = 1,000$ Hz). Spectrograms were generated using the following settings: FFT = 512, band width = 235 Hz, frequency resolution = 31 Hz, frame = 50%, window = FlatTop, overlap = 88%.

TABLE 1. Foraging behavior of White-throated Jacamars at Cocha Cashu, Manu National Park, Peru. Data are pooled from 14 timed, focal watches of four individuals on 27 August 2001. A flight of more than 5 m without attempting to capture prey was deemed a switch in foraging area.

Aspect of foraging behavior	Mean \pm SD (range)
Perch height (m)	14 \pm 4 (5–25)
Sallies (number/h)	40 \pm 20 (15–73)
Time interval between sallies (min)	1.4 \pm 1.1 (0.2–3.2)
Proportion of sallies successful	0.2 \pm 0.2 (0–0.5)
Sally distance (m)	9 \pm 6 (1–40)
Time spent in foraging area (min)	2.6 \pm 1.2 (0.3–7.8)
Distance between foraging areas (m)	12 \pm 7 (5–25)

meant that the direct distance between groups was shorter.

We located four active nests, all in burrows excavated in 1- to 3-m high vertical banks, 2–8 m from the stream, and all partially hidden behind overhanging vegetation such as fallen bamboo. The timing of these breeding attempts (in the middle of the dry season) coincided with peak breeding activity in most other bird species in the humid forests of southeastern Peru (Terborgh et al. 1990). Insect abundance probably is highest at this season. Nest design and placement appeared similar to that described for the Pale-headed Jacamar (Skutch 1968), although that species is not tied to watercourses. The aperture of cavity entrances was small (about 7 cm in diameter); we did not determine the interior dimensions or contents of nests so as to avoid disturbance.

On 27 August we made observations at one nest from 09:00–15:30 (GMT –04:00–02:30). All four adults in the group were feeding an unknown number of young; the adults regularly perched in a row with food items held in the bill (Fig. 1), and entered the nest hole sequentially. A minimum of four adults was feeding young at all four nests observed. This clearly demonstrates cooperative breeding (or at least cooperative provisioning) in this species, the first published evidence of such behavior in *Brachygalba*. Previous evidence for cooperative mating strategies for all galbulid genera has been anecdotal (for the gregarious *Galbalcyrrhynchus* and *Jacamaralcyon*), or anomalous (for *Galbula*; Sick 1993, Tobias 2002, E. O. Willis pers. comm.). Nonetheless, the fact that all *Brachygalba* species often are seen in small groups suggests that cooperative

breeding will be found to be widespread in the genus.

Adults remained within 80 m of the nest during our observations; they visited the nest 15–20 times/h (mean = 16.2 times/h \pm 3.4 SD) with intervals of 3 s to 34 min between visits (mean = 3.9 min \pm 0.6 SD). Before entering the nest cavity, they perched on an open branch about 2 m from the nest entrance for 10–312 s (mean = 64 s \pm 66 SD), and after entering they remained inside the cavity for 1–48 s (mean = 10.7 s \pm 14 SD).

All 92 identified food items brought to the nest hole were insects with a body length of 5–40 mm (mean = 18 mm \pm 6 SD, estimated to the nearest 5 mm using the 4.5-cm bill for scale). Of these, 47.8% were hymenopterans, 40.2% were lepidopterans, 11% were small odonates, and there was also a single cicada. Most (15.2%) of the positively identified lepidopterans were skippers (Hesperiidae), and many unidentified prey items probably were from this group; the remainder included several species of brush-footed butterflies (Nymphalidae) and whites and sulphurs (Pieridae). The predominance of skippers in the diet matches Skutch's (1968) observations of the Pale-headed Jacamar.

All four adults collected food by sallying from open perches in 25-m tall creekside *Cecropia* trees, a habit noted previously in western Brazil (Whittaker and Oren 1999). We gathered data on the technique and success of their aerial sallies during 14 foraging bouts of 3–16 min (mean = 8.2 min \pm 4.5 SD; Table 1). They performed a mean of 40 sallies/h, a rate comparable to that of the Green-tailed Jacamar *Galbula galbula* (Tobias 2002). This foraging rate presumably was higher than the

basal rate given the demands of chick provisioning; food items were fed to the young after 21% of the successful sallies. Although the observation period spanned the hottest part of the day when many rainforest species are inactive, flying insects were most easily captured at this time and the jacamars therefore foraged busily.

Foraging behavior and prey selection in jacamars is dependent upon the flight periods of insects and the age of nestlings (Tobias 2002). In this instance, nestlings probably were >10 ten days old given the high provisioning rate, the large size of some food items offered, and the fact that food was sometimes provisioned just inside the burrow entrance rather than in the terminal nest cavity. No birds could be found in the vicinity of the nest four days later, and the chicks were presumed to have fledged or been predated.

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